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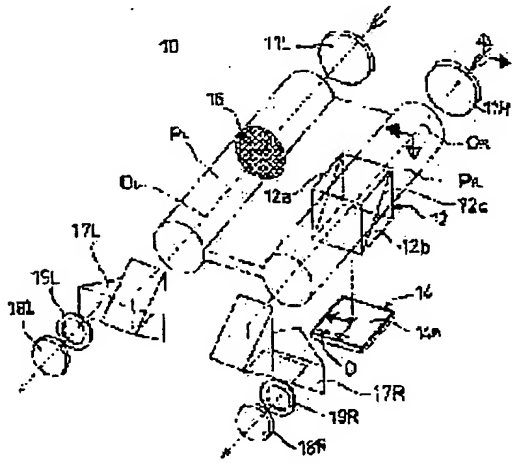
(54) BINOCULARS EQUIPPED WITH DIGITAL CAMERA

(57)Abstract:
PROBLEM TO BE SOLVED: To miniaturize binoculars, to make the binoculars light in weight and to reduce the cost by installing an image pickup element for directly receiving the luminous flux of light reflected outside an optical path by a beam splitter arranged in the optical path between an objective optical system and an eyepiece optical system for one observation optical system without the intermediary of a reflection optical system.
SOLUTION: The beam splitter 12 is fixed in the optical path PR between an objective lens group 11R and a polyprism 17R. And a CCD image pickup element 14 for picking up the observation object image in operation of observation through the binoculars 10 as electrical image data is installed. And the image pickup element 14 is fixed separately from the beam splitter 12 at an interval of a prescribed distance so that the luminous flux reflected outside the optical path PR by the half mirror 12c of the beam splitter 12 may be directly image-formed on the image pickup surface 14a. Besides, the reflection optical system such as a prism, etc., is not installed between the beam splitter 12 and the image pickup element 14. Thus, the small-sized, light-weight binoculars equipped with a digital camera having such a simplified structure is obtained.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention relates to the binocular which has a digital camera in one.
[0002]
[Description of the Prior Art] The binocular with which the silver salt film formula camera was attached, and the so-called binocular with a camera are known. According to this binocular with a camera, the observation object under observation can be photoed easily and quickly. With these conventional binoculars with a camera, a beam splitter is arranged into one optical system of the observation optical system of a right-and-left couple, and the prism which is made to carry out incidence of the flux of light which carries out outgoing radiation from this beam splitter further, and is led to a film plane is arranged. That is, after the flux of light by which a part of flux of light which passes along one observation optical system by the above-mentioned beam splitter was drawn out of this optical system, and it was led to this exterior is reflected by the above-mentioned prism, it has structure led to a film plane.
[0003] The image tied on a film plane needs to be either an erect image or an inverted image. Since the image by the flux of light drawn by the above-mentioned beam splitter out of observation optical system turns into a right-and-left reversal (inside-out) image, it is made into either the erect image or the inverted image using catoptric system, such as the above-mentioned prism.
[0004] Above, like, with the conventional binoculars with a camera, since it is necessary to prepare catoptric system, such as one beam splitter and at least one or more prism, equipment will be enlarged. With the further conventional binoculars with a camera, since it is necessary to prepare mechanical elements, such as a film room, a cartridge room, a loop wheel machine style, and a shutter mechanism, in addition to these beam splitters or prism, enlargement of equipment is not avoided.
[0005]
[Objects of the Invention] this invention was accomplished in view of the above trouble, and aims to let structure offer an easy and small lightweight binocular with a digital camera.
[0006]
[Summary of the Invention] The beam splitter by which this invention has been arranged in the optical path between the observation optical system of the couple which has object optical system and eyepiece optical system respectively in the binocular with a digital camera which prepared the digital camera in one at the binocular, the object optical system in; one observation optical system, and eyepiece optical system; it is characterized by having the image pck-up element which receives directly the reflected light bunch reflected by this beam splitter out of the above-mentioned optical path without catoptric system, and;.
[0007] That is, the binocular with a digital camera which applied this invention draws a part of flux of light which passes along one observation optical system by the beam splitter out of this optical system, and has the composition which carries out direct image formation of this drawn flux of light on the image pck-up element which is an electronic device. Since direct incidence of the reflected light bunch reflected by the above-mentioned beam splitter out of the above-mentioned optical path is carried out to an image pck-up element according to this composition, on an image pck-up element, image formation of the right-and-left reversal (inside-out) image is carried out. However, whenever it reads in order of predetermined read-out which wrote temporarily the image data of the image by which image formation was carried out on this image pck-up element in the image memory etc., and set up after that this image data written in temporarily beforehand, the picture as an erect image can be acquired. that is, whenever the sense of the image by which image formation is carried out to the installation sense of an image pck-up element and the image pck-up side of thisimage pck-up element sets up beforehand the read-out [what] sequence of the image data corresponding tothe sense even if it is suitable, come out and it is, it can acquire the picture as an erect image Therefore, according to the composition of the above-mentioned this invention, the flexibility of arrangement of an image pck-up element or each optical faculty material is high, and since it is not necessary to prepare catoptric system, such as prism, between the above-mentioned beam splitter and an image pck-up element, a miniaturization and lightweight-izing of equipment can be attained.
[0008]
[Embodiments of the Invention] Based on an illustration implementation form, this invention is explained below. Drawing 1 shows the 1st operation form of the binocular with a digital camera which applied this invention. This binocular 10 with a digital camera is the type which attached the digital camera to the Porro prism formula binocular. In addition, all over this drawing, only the important section concerning the observation optical system and this invention of the binocular 10 with a digital camera is shown.
[0009] The binocular 10 with a digital camera has the left-hand side observation optical system which consists of the observation optical system of the right-and-left couple which a common Porro prism formula binocular has, i.e., objective lens group 11L, Porro prism 17L, and ocular group 18L, and the right-hand side observation optical system which consists

of objective lens group 11R, Porro prism 17R, and ocular group 18R. Between the outgoing radiation side of each Porro prisms (erection optical system) 17L and 17R, and the ocular groups 18L and 18R of correspondence, field diaphragms 19L and 19R are being fixed.

[0010] Each set object lens groups 11L and 11R are the object opticals axis OL and OR of correspondence. It meets, shows around possible [movement] by one at the cross direction, and moves approximately according to rotation of the focus ring (not shown) prepared in the center of abbreviation of binocular 10 with a digital camera main part. That is, if this focus ring is rotated suitably, the objective lens groups 11L and 11R will move forward and backward, and a focus will be performed.

[0011] Optical path PR between objective lens group 11R and Porro prism 17R The beam splitter 12 is being fixed inside. One-way mirror (semitransparent mirror) 12c which this beam splitter 12 comes to join each bases of two rectangular prisms 12a and 12b, and consists of a metal thin film on the plane of composition of one rectangular prism is formed. A beam splitter 12 is the object optical axis OR of one-way mirror 12c so that a part of flux of light which carried out incidence to objective lens group 11R from the exterior reflects by one-way mirror 12c, and the remaining flux of lights may penetrate one-way mirror 12c and may carry out incidence to Porro prism 17R. The receiving tilt angle is set as 45 degrees, and it is an optical path PR. It is arranged inside. Object optical axis OR of this one-way mirror 12c The receiving tilt angle is not limited only to 45 degrees in this operation form, but can be set as arbitrary angles.

[0012] Optical path PL between objective lens group 11L and Porro prism 17L ND filter 16 is being fixed inside. In the observation optical system in which the beam splitter 12 was formed, since the quantity of light which goes to the eyepiece side is reduced by one-way mirror 12c, the quantity of light which goes to the eyepiece side in observation optical system on either side by installing this ND filter 16 is equalized.

[0013] Moreover, CCD image sensor 14 for picturizing the observation body image under observation as electric image data with this binocular is formed in the binocular 10 with a digital camera. This CCD image sensor 14 is an optical path PR by one-way mirror 12c of a beam splitter 12. It is fixed to the predetermined length remote position from the beam splitter 12 so that the flux of light (observation body image) reflected outside may carry out image formation directly on the image pck-up side (light-receiving side) 14a. Catoptric system, such as prism, is not prepared between the beam splitter 12 and CCD image sensor 14.

[0014] Each image which consists of an arrow which has a white arrowhead, and an arrow which has a black-colored arrowhead shows the sense in each position of an observation body image until it results in CCD image sensor 14 among drawing 1 . From the sense of each [these] arrow, he can understand that image formation of the right-and-left reversal (inside-out) picture is carried out on image pck-up side 14a. Moreover, the arrow D shown on image pck-up side 14a of CCD image sensor 14 shows the scanning origin and the scanning direction among drawing 1 . The scanning origin of CCD image sensor 14 corresponds to the position at the upper right of the observation body image of an erection state so that it may understand from the position of this arrow D.

[0015] Moreover, the image recording circuit 20 containing CCD image sensor 14 is established in the binocular 10 with a digital camera (refer to drawing 3). The image recording circuit 20 has CCD image sensor 14, amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, and main memory 25. Furthermore, the image recording circuit 20 has CCD image sensor 14, A/D converter 22, an image memory 23, the image-processing section 24 and the system-control section 26 electrically connected to each of main memory 25, and the shutter release switch 27 electrically connected to this system-control section 26.

[0016] The shutter release switch 27 is interlocked with release ** (not shown) prepared in binocular 10 with a digital camera main part, and is opened and closed. The system-control section 26controls each of CCD image sensor 14, amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, and main memory 25 according to the state of the shutter release switch 27.

[0017] If the depression of the release ** is carried out, the shutter release switch 27 will be switched on, the system-control section 26 drives CCD image sensor 14 by ON of this shutter release switch 27, and an image pck-up is started. The analog picture signal acquired by the photo electric translation of CCD image sensor 14 is inputted into back A/D converter 22 amplified with amplifier 21, and is changed intoa digital image signal. Then, this changed digital image signal is once written in the image memory 23 which consists of RAM etc. The digital image signal written in an image memory 23 at this time is written in as image data of the right-and-left reverse image for one screen.

[0018] The image data based on the horizontal scanning of a right-and-left reverse image by which image formation is carried out to image pck-up side 14a of CCD image sensor 14 is recorded on an image memory 23 by 1 to 1at the time of the writing of the digital image signal to this image memory 23. That is, a right-and-left reverse image is recorded also on memory cell array 23a (drawing 4) of an image memory 23 in a bit image.

[0019] Then, the image data to which the image-processing section 24read the image data written in this image memory 23, processed gamma amendment, the color correction, the data compression, etc., and performed this compression processing etc. after that is written in main memory 25. When reading the image data from an image memory 23, the image-processing section 24 writes in horizontally addressing of memory cell array 23a of an image memory 23, and at the time, it is specifying by the right-and-left reverse order, and it reads it as the right-and-left reverse (noninverting picture), i.e., the right picture, of a right-and-left reverse image. The picture read to main memory 25 as this right picture is recorded on the predetermined address. In addition, main memory 25 can consist of record media, such as a flash memory, a magnetic disk, and a magneto-optic disk.

[0020] Drawing 4 shows signs that the image information by the horizontal scanning of a right-and-left reverse image by which image formation is carried out to image pck-up side 14a of CCD image sensor 14is recorded on memory cell array 23a of an image memory 23 by 1 to 1 as a bit image of a right-and-left reverse image. The left figure indrawing 4 shows the situation of the horizontal scanning in a **** case for image pck-up side 14a of CCD image sensor 14 from the background, and the right figure in drawing 4 shows signs that the image data obtained by this horizontal scanning is recorded on memory cell array 23a of an image memory 23 by 1 to 1. Memory cell array 23a consists of the number of

record cells corresponding to the number of pixels of CCD image sensor 14, i.e., the number of cells of i(total number of cells in direction of X) xj (the total number of cells in the direction of Y).
[0021] Drawing 5 and drawing 6 are flow charts which show the writing of the image data to memory cell array 23a, and processing of read-out. Processing of this flow chart is started at the time of the write-in start of the image data to memory cell array 23a. First, the write-in position (X, Y) of memory cell array 23a is set as (0, 0) (initialization), 1 is continuously added to Y, 1 is further added to X, and a memory write-in position is specified (Step S1 - S4). Therefore, the write-in position at the time of a memory write-in start (write-in origin) is set as (1, 1).
[0022] It judges whether X is i (X is the maximum) after step S4, if it is not X=i (i.e., if X is under i (X<i)), processing of Step S3 and S4 will be performed again, and it progresses to Step S6 whichwill continue if it is X=i, and X is set to 0.
[0023] It judges whether Y is j (Y is the maximum) after Step S6, if it is not Y=j (i.e., if Y is under j (Y<j)), processing of Steps S2-S6 will be performed again, and it progresses to Step S8 which will continue if it is Y=j. All specification of the write-in position of the image data to memory cell array 23a is performed by processing to the above steps S1-S7. That is, all specification of the write-in position of the image data to memory cell array 23a is performed from a write-in origin (1 1) in order of (2, 1), (3, 1), ..., (i, 1), (1, 2), (2, 2), (3, 2), ..., (i, 2), (1, 3), (2, 3), ..., (i, j). The image data outputted from A/D converter 22 is written in memory cell array 23a one by one in order of specification of this write-in position
[0024] At Step S8, (X and Y) are set as (i+1 and 0). Then, 1 is added to Y, 1 is further subtracted from X, and a memory read-out position is specified (Step S9- S11). Therefore, the read-out position at the time of a memory read-out start (read-out origin) is set as (i, 1). This read-out origin corresponds tothe position at the upper left of the observation body image of an erection state.
[0025] It judges whether X is 1 after Step S11, if it is not X= 1, processing of Steps S10 andS11 will be performed again, and it progresses to Step S13 which will continue if it is X= 1, and X is set to i+1.
[0026] It judges whether Y is j (Y is the maximum) after that, if it is not Y=j (i.e., if Y is under j (Y<j)), processing of step S9-S13 will be performed again, and if it is Y=j, processing of this flow chart will be ended. . All specification of the read-out position of the image data to memory cell array 23a is performed by processing to the above steps S8-S14. That is, (i-1 from read-out origin (i, 1), 1), (i-2, 1), ..., (1, 1) (i, 2) (i-1, 2), (i-2, and 2), ..., (1, 2) (i, 3) (i-1, 3), All specification of the read-out position of the image data to memory cell array 23a is performed in order of ....., and (1, j). The image data read from memory cell array 23a turns into image data of the right picture which right and left have not reversed, and this image data is recorded on the main memory 25 after operation, such as compression processing, by this read-out sequence.
[0027] As mentioned above, the binocular 10 with a digital camera of the 1st operation form which applied this invention does not need any catoptric system, such as prism, between a beam splitter 12 and CCD image sensor 14. Therefore, the miniaturization and lightweight-izing of a part and the main part of equipment which do nct need catoptric system, such as prism, are attained.
[0028] Although the binocular 10 with a digital camera of the above-mentioned 1st operation form has the observation optical system of the Porro prism formula binocular which uses the Porro prism as erection optical system, even if it makes it the composition which replaces each Porro prisms 17L and 17R with a roof prism, and has the observation optical system of a roof prism formula binocular, it can expect the same effect.
[0029] Drawing 2 shows the 2nd operation form of the binocular with a digital camera which applied this invention The binocular 30 with a digital camera of this 2nd operation form has the observation optical system of the roof prism formula binocular which uses a roof prism as erection optical system.
[0030] The binocular 30 with a digital camera has the left-hand side observation optical system which consists of the observation optical system of the right-and-left couple which a common roof prism formula binocular has, i.e., objective lens group 31L, roof prism 32L, and ocular group 34L, and the right-hand side observation optical system which consists of objective lens group 31R, roof prism 32R, and ocular group 34R. Between the outgoing radiation side of each roof prisms 32L and 32R, and the ocular groups 34L and 34R of correspondence, field diaphragms 38L and 38R are being fixed.
[0031] With this 2nd operation form, the whole surface of a reflector with two or more one roof prisms is one-way-mirror-ized, and the same function as one-way mirror 12c in the above-mentioned 1st operation form is given to this one-way-mirror-ized reflector.
[0032] That is, as shown in drawing 2 , one of the reflectors with two or more roof prism 32R of right-hand side observation optical system is formed as one-way mirror 32a. This one-way mirror 32a reflects a part of flux of light which carried out incidence from the objective lens group31R side, makes the remaining flux of lights penetrate, and is drawn out of an observation optical path. And image formation of the flux of light (observation body flux of light) drawn out of this optical path is carried out on image pck-up side 14a of CCD image sensor 14 fixed to the predetermined length remote position from roof prism 32R.
[0033] Between objective lens group 31L of left-hand side observation optical system, and roof prism 32L, ND filter 16 for equalizing the quantity of light which goes to the eyepiece side in observation optical system on either side like the binocular 10 with a camera of the 1st operation form is being fixed.
[0034] Moreover, the image recording circuit 20 (drawing 3) containing CCD image sensor 14 is established in the binocular 30 with a digital camera like the binocular 10 with a digital camera. The control mode by this image recording circuit 20 is performed like the binocular 10 with a digital camera mentioned above.
[0035] As mentioned above, with the binoculars 30 with a digital camera of the 2nd operation form which applied this invention, since it was made the composition which prepares one-way mirror 32a in roof prism 32R, catoptric system, such as prism, is not needed between the optical member of the exclusive use for preparing this one-way mirror 32a, this optical member, and CCD image sensor 14. Therefore, a miniaturization and lightweight-izing of the main part of equipment can be further attained rather than the binocular 10 with a digital camera of the 1st operation form, and a cost cut can be aimed at.

[0036] With each above operation form, the read-out origin of memory cell array 23a is set as (i, 1). (i-1 from this origin, 1), (i-2, 1), ..., (1, 1) (i, 2) (i-1, 2), (i-2, and 2), ..., (1, 2) (i, 3) (i-1, 3), Although it was made ..... and the composition which specifies the read-out position of the image data to memory cell array 23a in order of (1, j), this invention is not limited in order of this read-out tab control specification. What is necessary is just to set up suitably the read-out direction from the read-out origin and this read-out origin of memory cell array 23a by the difference in the sense of an image by which image formation is carried out to the installation sense of CCD image sensor 14, and image pck-up side 14a, so that the image data after read-out may turn into image data of an erect image.

[0037] for example, when the image by which image formation is carried out to image pck-up side 14a is an inverted image of right-and-left reversal The read-out origin of memory cell array 23a is set to (1, j). 1 ((2, j) from this origin, (3, j), ..., (i, j), (1, j-1), (2, j-1), (3, j-1), ..., (i, j-1), j-2), If it is made ..... and the composition which specifies the read-out position of the image data to memory cell array 23a in order of (i, 1), the image data after read-out will turn into image data of an erect image.

[0038] Moreover, with each above-mentioned operation form, by arranging the component part (amplifier 21, A/D converter 22, an image memory 23, the image-processing section 24, main memory 25, stem control section 26 grade) of the digital camera section between observation optical system on either side, the whole equipment can be constituted in a flat configuration and a miniaturization can be attained.

[0039] It may replace with the beam splitter 12 of the above-mentioned 1st operation form, and you may make it the composition which prepares the pellicle mirror which has one-way mirror 12c and this function.

[0040]

[Effect of the Invention] According to the binocular with a digital camera which applied this invention above like A beam splitter is arranged in the optical path between the object optical system in one observation optical system, and eyepiece optical system. Since it was made the composition which prepares the image pck-up element which receives directly the reflected light bunch reflected by this beam splitter out of the above-mentionedoptical path without catoptric system There is no need of preparing catoptric system, such as prism, between a beam splitter and an image pck-up element like in the binocular with a camera using the conventional silver salt film. Moreover, since there is no need of preparing mechanical elements, such as a required film room, a cartridge room, a loop wheel machine style, and a shutter mechanism, when using a silver salt film, the miniaturization of equipment, lightweight-izing, a cost cut, etc. can be aimed at.

[0041] furthermore -- since the picture as an erect image can be acquired whenever the sense of the image by which image formation is carried out to the installation sense of an image pck-up element and the image pck-up side of thisimage pck-up element sets up beforehand the read-out [what] sequence of the image data corresponding tothe sense even if it is suitable, come out and it is -- an image pck-up element and each optics -- the flexibility of arrangement of a member is high

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[Translation done.]

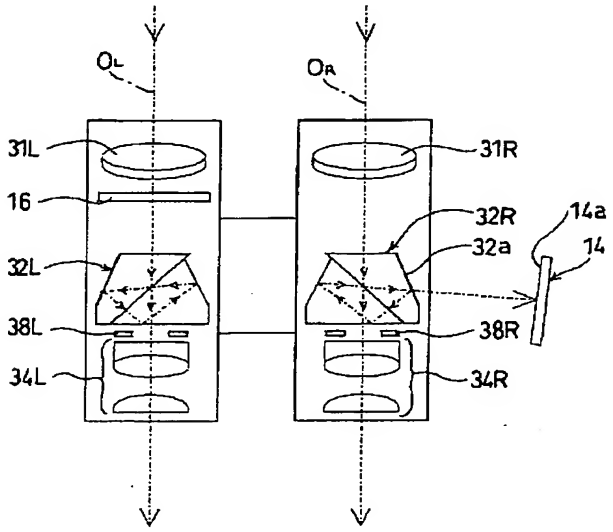
* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The beam splitter arranged in the optical path between object optical system, the observation optical system of the couple which has eyepiece optical system respectively, the object optical system in; one observation optical system, and eyepiece optical system; the binocular with a digital camera characterized by having the image pck-up element which receives directly the reflected light bunch reflected by this beam splitter out of the above-mentioned optical path without catoptric system, and;.
[Claim 2] It is the binocular with a digital camera arranged between object optical system [in / above-mentioned one observation optical system / on a binocular with a digital camera according to claim 1, and / in a beam splitter], and the erection optical system formed in the eyepiece side of this object optical system.
[Claim 3] It is the binocular with a digital camera which is the one-way mirror prepared as one of the reflectors of the plurality [in the binocular with a digital camera according to claim 1, the roof prism is formed in the eyepiece side of the object optical system in above-mentioned one observation optical system as erection optical system, and / beam splitter] of this roof prism.
[Claim 4] The binocular with a digital camera which has the ND filter further fixed to the claim 1 or any 1 term of 3 in the optical path of the observation optical system of another side in the binocular with a digital camera of a publication.
[Claim 5] It is the binocular with a digital camera whose image pck-up element is a CCD image sensor in a binocular with a digital camera given in a claim 1 or any 1 term of 4.

[Translation done.]

Drawing selection drawing 2



[Translation done.]